GRAIN SIZE ANALYSIS, OPTICAL REFLECTIVITY MEASUREMENTS
AND DETERMINATION OF HIGH FREQUENCY ELECTRICAL PROPERTIES FOR
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Grain Size Analysis. The particle size distribution of the
Apollo 14 lunar fines has been determined by the method of
measuring the sedimentation rate in a column of water. This
method was described in the Apollo 12 report; it is very useful
for the purpose of comparison.

Figure 1a compares the differential particle size distribu-
tion of the Apollo 14 bulk fines with that of two core samples
taken from different depths. Among these samples there seems to
be no significant variation in the grain size distribution.
This result could either imply that the 14230 core sample is in-
trinsically homogeneous and that the core fines have the same
origin (down to a depth of 20 cm) as the surface bulk fines col-
lected nearby, or that this core tube sample was perhaps highly
disturbed.

Fig. 1a
Fig. 1b
Figure 1b compares the differential particle size distribution of 3 surface fine samples: one from each Apollo mission. From these curves it would appear that A14163 is finer grained than either the Apollo 11 or Apollo 12 fines.

Reflectivity Measurements, Surface Darkening by Simulated Solar Wind. It has been proposed (first by Gold in 1960) that the low albedo of the lunar soil is due to sputtering effect of the solar wind. In order to further investigate this possibility, lunar fines from different Apollo missions have been subjected to simulated solar wind in this laboratory. The albedo of these samples was determined before and after irradiation. As can be seen in Figure 2, the albedo of both the Apollo 11 bulk fines and the more reflectant Apollo 14 bulk fines decreased significantly after being subjected to approximately $1.5 \times 10^5$ years of solar wind. The albedo of a finely ground terrestrial olivine basalt sample decreased from 34.3% (at $10^0$ phase angle and $\varepsilon=0^0$ viewing angle) to 22.8% after being irradiated with approximately $5 \times 10^3$ years of solar wind in the same experimental conditions.

Figure 2: Reflectivity of an Apollo 11 and an Apollo 14 powder sample before and after being subjected to simulated solar wind (2 keV, 0.16 mA/cm² proton beam, irradiation times: 13.5 hours and 14.75 hours respectively).

Electrical Properties. Two surface fines samples (A14163 and A14003) and one rock sample (14310.161) have been analyzed. The dielectric constant measurements are reported in Figure 3, the power absorption length in these samples is shown in Figure 4. (Some earlier Apollo 11 and 12 data are also shown on these figures.) The striking result is the very long absorption length, 28 wavelength, observed for the Apollo 14 rock sample, 14310.161 at 430 MHz compared to only 1.7 wavelength for the Apollo 12 rock sample, 12063.89. The density and dielectric constants of these two rock samples were both similar. The power absorption of rock 12063.89 is typical for other Apollo 11 and 12 rock samples as well.

The Apollo 14 dust samples are also less absorbent than the Apollo 11 and 12 samples. At a packing density of $1.6g/cm^3$ the absorption length is approximately $34$ wavelengths or $2.2$ times greater than the absorption length in A10084 or $3.5$ times.
greater than that in A12003.

The low absorption observed adds new significance to lunar radar observations. Thus at a wavelength of 10 meters reflections from a depth of over 100 meters may well contribute very significantly to the radar echoes. If any soil exists that is the pulverized version of rock 14310 then a radar penetration of 70 wavelengths would be expected. Materials of such low absorption are not a common constituent of the crust of the earth.